

# Economic support mechanisms and design of markets

**Skytte, Klaus**

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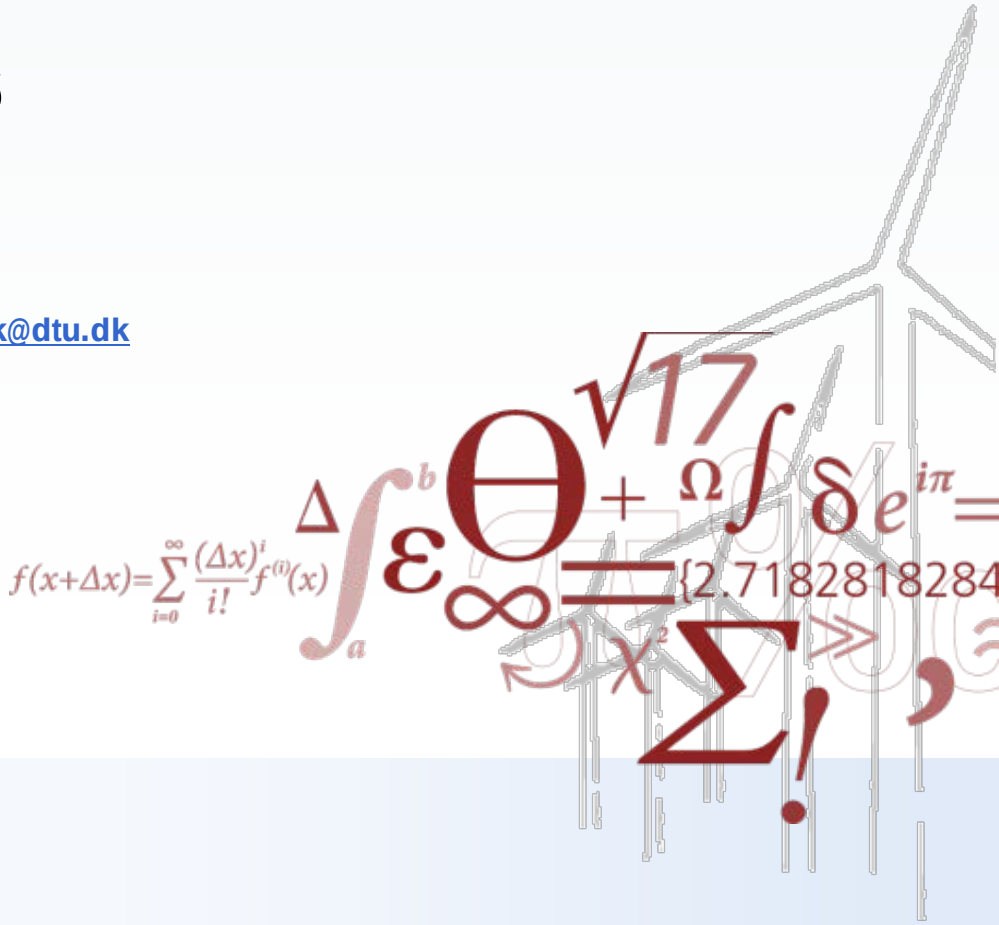
# Economic support mechanisms and design of markets

**Klaus Skytte** Klsk@dtu.dk
*DTU Management Engineering*
Energy Systems Analysis

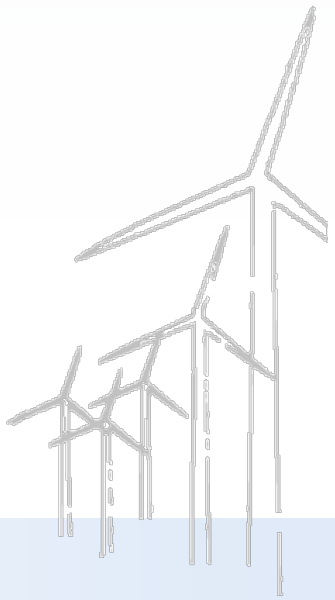
Sub-Programme on Economic and Social aspects of wind integration
26 September 2014




DTU Management Engineering
Department of Management Engineering

# Agenda

- Research motivation
- Support mechanisms
- Market Design: Regulatory framework challenges
  - Research case 1:
    From passive to active dynamic generation / market actors
  - Research case 2:
    Regulating future offshore grids

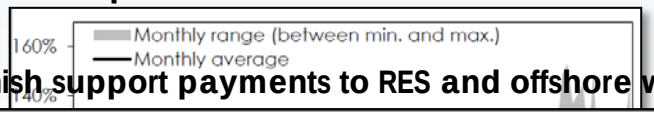


# Research motivation

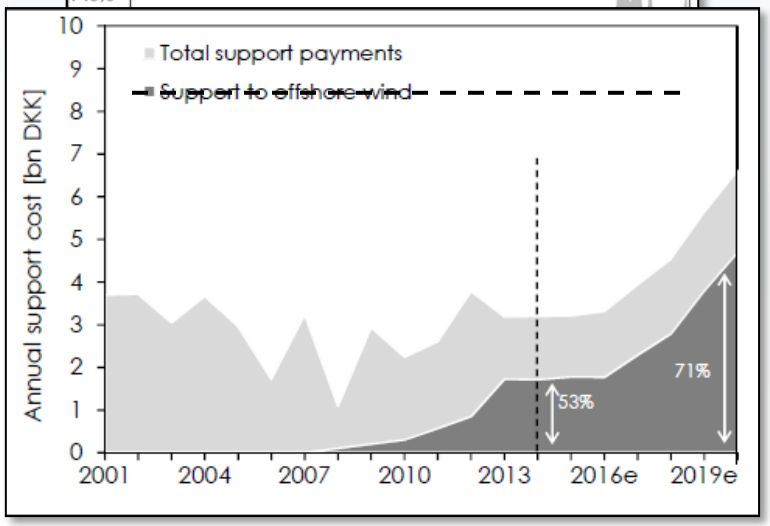
- The new electricity systems: From centralised and fossil-intensive systems to sustainable and integrated
- Increasing shares of renewable energies (RES)
- Total support costs expected to increase

⇒ *important that the right* ***support mechanisms*** *are used and the* ***support levels*** *are adequate*

**Wind production share in DK-West**




**Danish support payments to RES and offshore wind**

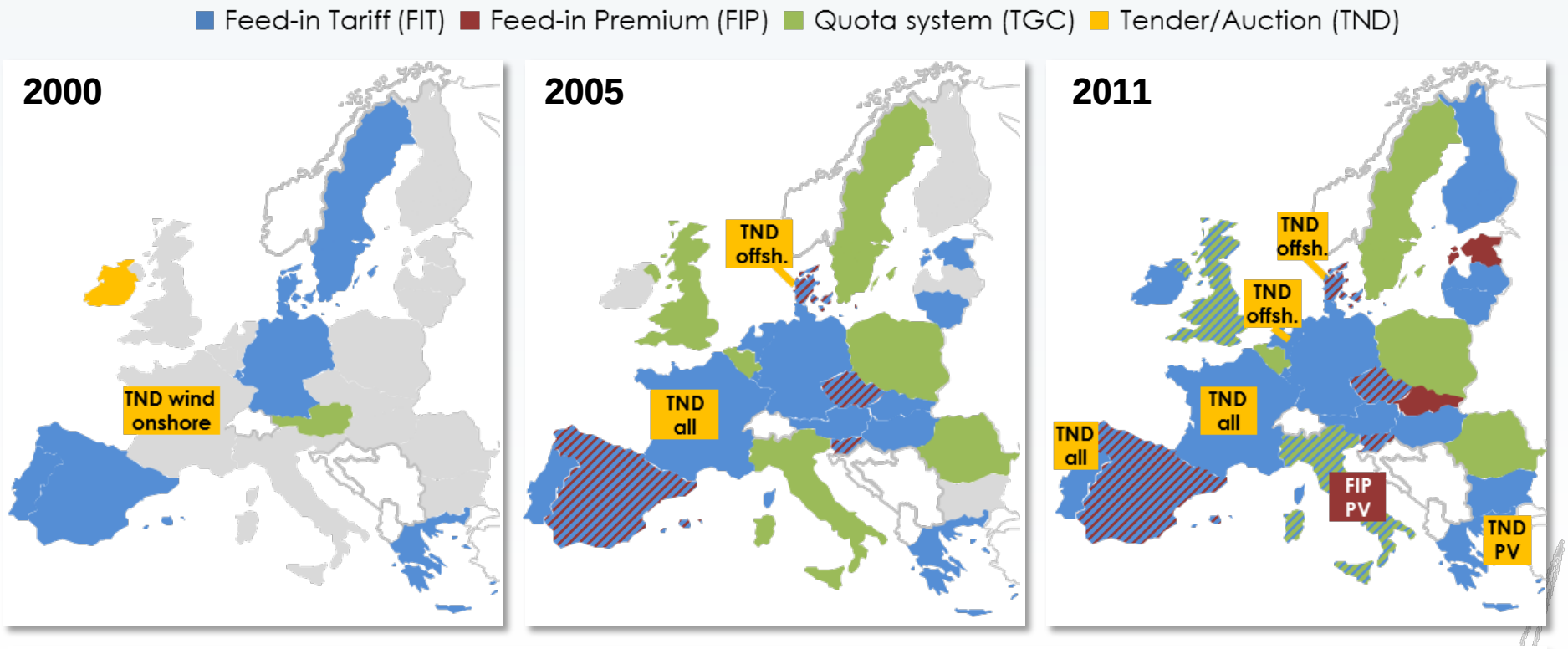



Wind power provided a world record 41.2% of Danish electricity consumption for first 6 months of 2014

- National support schemes are rapidly changing, with new instruments being introduced and existing instruments being adapted
- Trend to more ***market integration*** and need of more ***flexibility***

⇒ ***Research is needed for analysing the effects of different regulatory framework conditions, both qualitatively and quantitatively***

# Development of support schemes in the EU-27




- **Feed-in Tariffs by far dominant (21 countries)**
- **Feed-in Premiums have recently surpassed quota systems**
- **Investment grants, tax breaks, financing support are used as supplementary support instruments in all countries**
- **Application of different instruments in parallel: From on average 1 in 2000 to 3 instruments in 2011 (Denmark uses 6 instruments – highest in EU)**

# Regulatory framework challenges

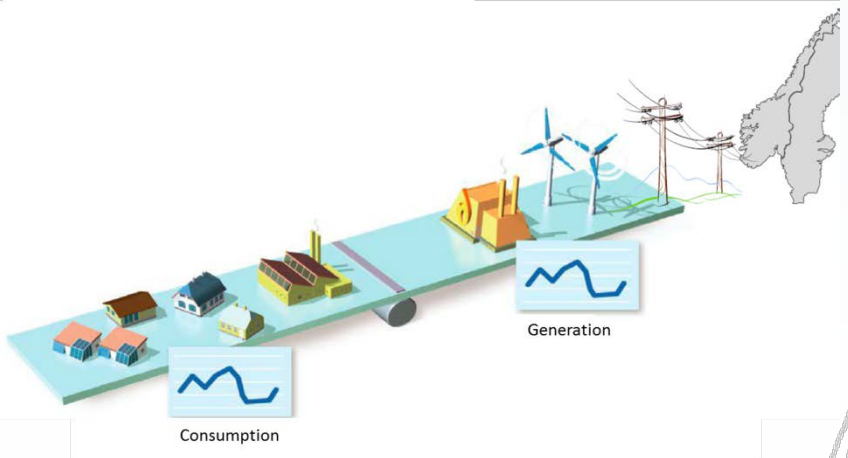
## Market integration and flexibility

**From passive to active dynamic generation / market actors**

- Act to negative prices at the spot market (day-ahead)
  - Case: Change in market design from 2009: negative prices at NordPool
    - Close down of wind turbines in hours with neg prices = saved costs
- Active at the balancing markets

  Close down of wind = down regulation

☺ **Case Denmark**: New wind turbines gets a Feed In Premium in certain full load hours (depending on size). When down-regulation, the not "used" full load hour with support can be used later.




☹ **Case Denmark**: Some existing off-shore tenders have no incitements for WTs to be active in down-regulation.

☺ One (Anholt) doesn't receive FIT when negative prices.

# Managing **Negative** Spot Prices

Case: Sund & Bælt wind farm – 16. March 2014

**Elspot prices**

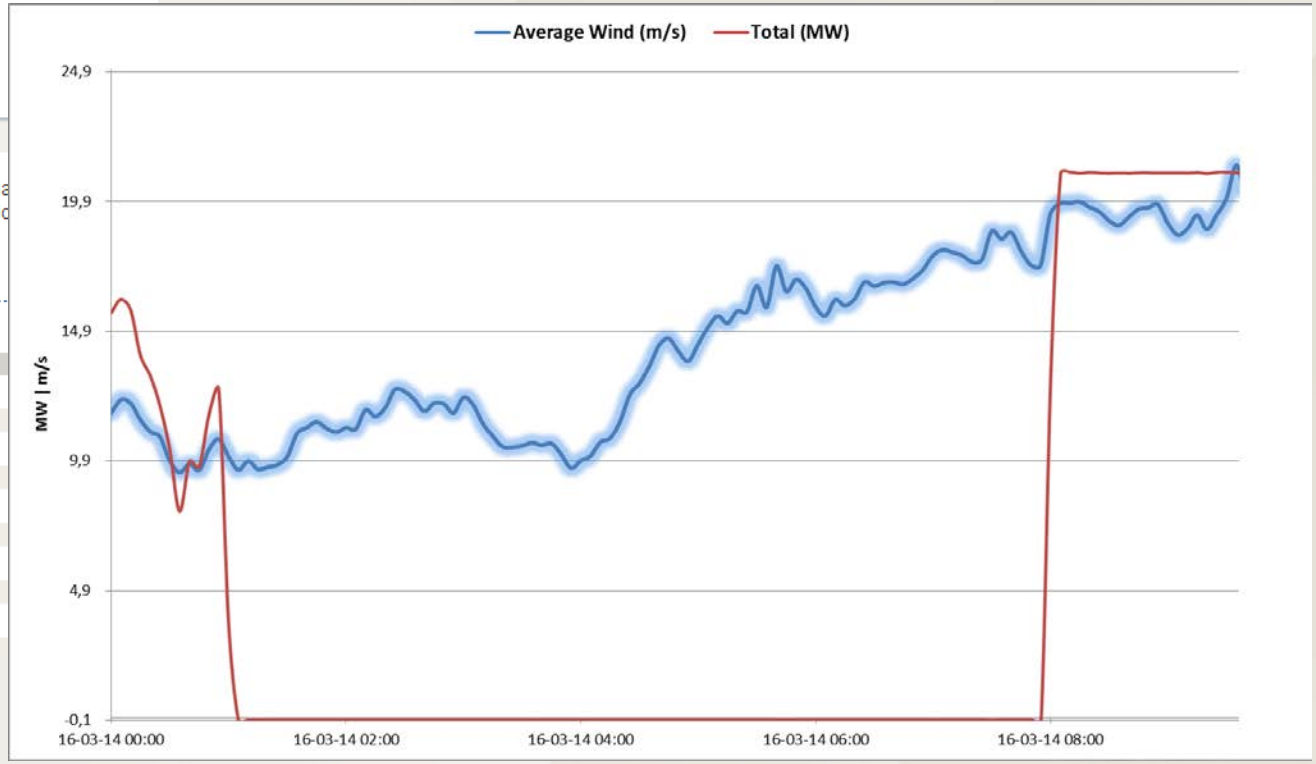
ALL SYS NO SE FI DK EE LT LV

- further details -

Please note that changes in the Norwegia
comparison between present and historic
the area change log pdf.

EUR/MWh

| | DK1 |
|---|---|
| 16-03-2014 | |
| 00 - 01 | -0,02 |
| 01 - 02 | -25,08 |
| 02 - 03 | -25,06 |
| 03 - 04 | -60,26 |
| 04 - 05 | -50,65 |
| 05 - 06 | -50,12 |
| 06 - 07 | -25,08 |
| 07 - 08 | -25,00 |
| 08 - 09 | 0,05 |
| 09 - 10 | 10.77 |



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# Managing **Negative** balancing Prices

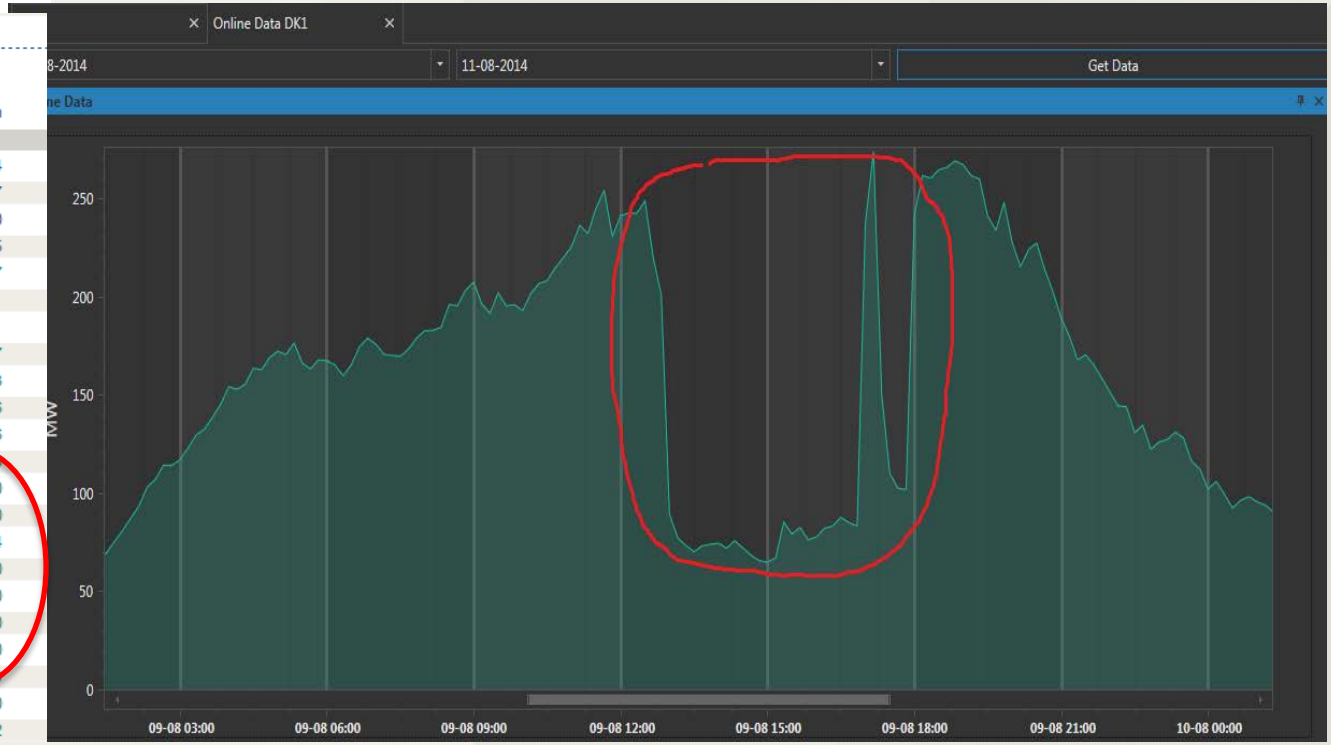
Case: Down ward regulation – 9 August 2014

## Regulating prices

ALL NO SE FI DK

DKK/MWh

| | DK1 | |
|---|---|---|
| | Up | Down |
| 09-08-2014 | | |
| 00 - 01 | 248,34 | 247,34 |
| 01 - 02 | 213,27 | 213,27 |
| 02 - 03 | 200,90 | 200,90 |
| 03 - 04 | 196,95 | 196,95 |
| 04 - 05 | 188,60 | 138,07 |
| 05 - 06 | 183,38 | 124,71 |
| 06 - 07 | 179,65 | 124,71 |
| 07 - 08 | 194,04 | 138,07 |
| 08 - 09 | 200,15 | 151,43 |
| 09 - 10 | 204,25 | 178,16 |
| 10 - 11 | 207,91 | 178,16 |
| 11 - 12 | 207,31 | 178,16 |
| 12 - 13 | 200,68 | -90,00 |
| 13 - 14 | 189,05 | -90,00 |
| 14 - 15 | 186,06 | -541,94 |
| 15 - 16 | 200,75 | -90,00 |
| 16 - 17 | 200,82 | -90,00 |
| 17 - 18 | 191,88 | -90,00 |
| 18 - 19 | 225,42 | -50,00 |
| 19 - 20 | 240,26 | 155,82 |
| 20 - 21 | 246,22 | 182,70 |
| 21 - 22 | 249,20 | 193,82 |



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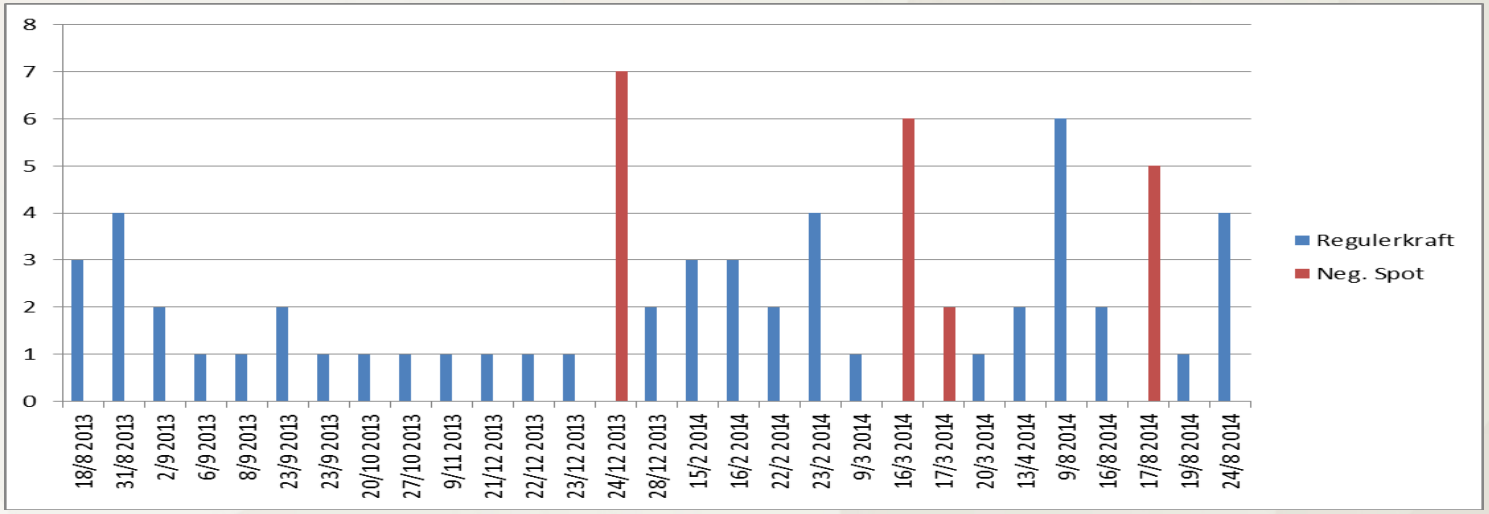
# Last year with active participation of wind turbines in ancillary service




Activations where negative regulating prices are below -50 DKK/MWh.

- 25 times
- 51 hours



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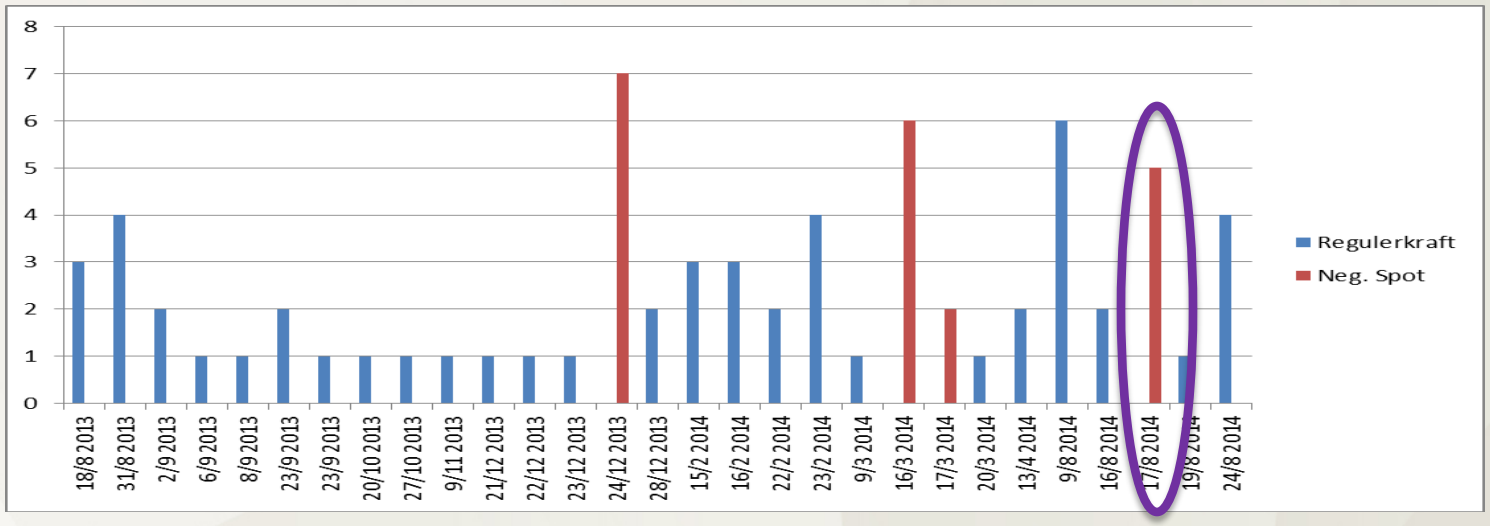
# Last year with active participation of wind turbines in Day Ahead market.

Hours

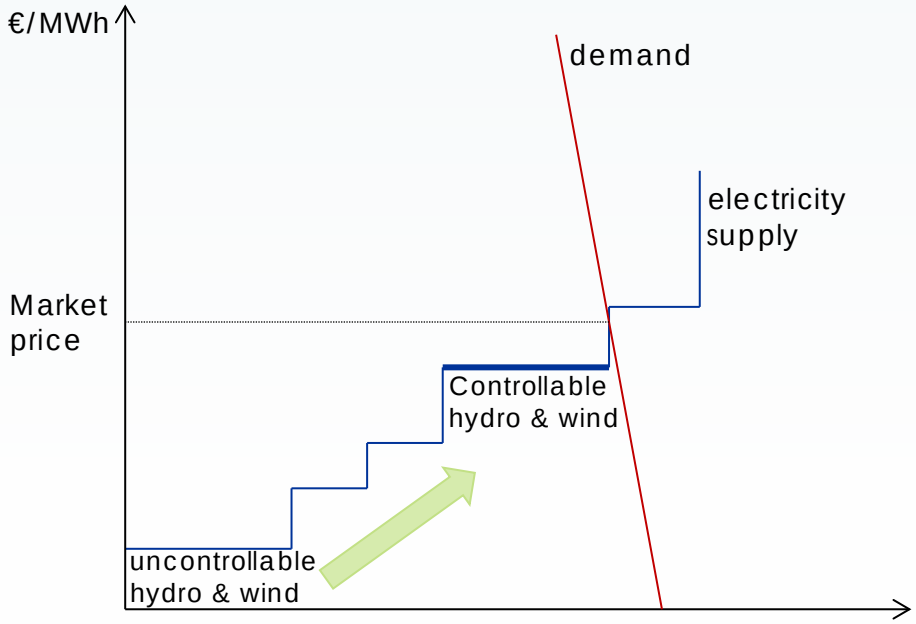



Protection against negative spot prices 17. august 2014.

- Day Ahead trading resulted in negative spot prices
  - Wind production was expected at high level
  - Wind production considerable lower than expected
  - Wind turbines were used actively and did not stop at all.

# Wind value

- Similar to water, you can talk about a **wind value** when the generation becomes active at the market




- Goal to create adequate **regulatory framework conditions** and **market designs** that facilitate and stimulate active wind participation
  - Reach the highest wind value possible

# Regulating future offshore grids

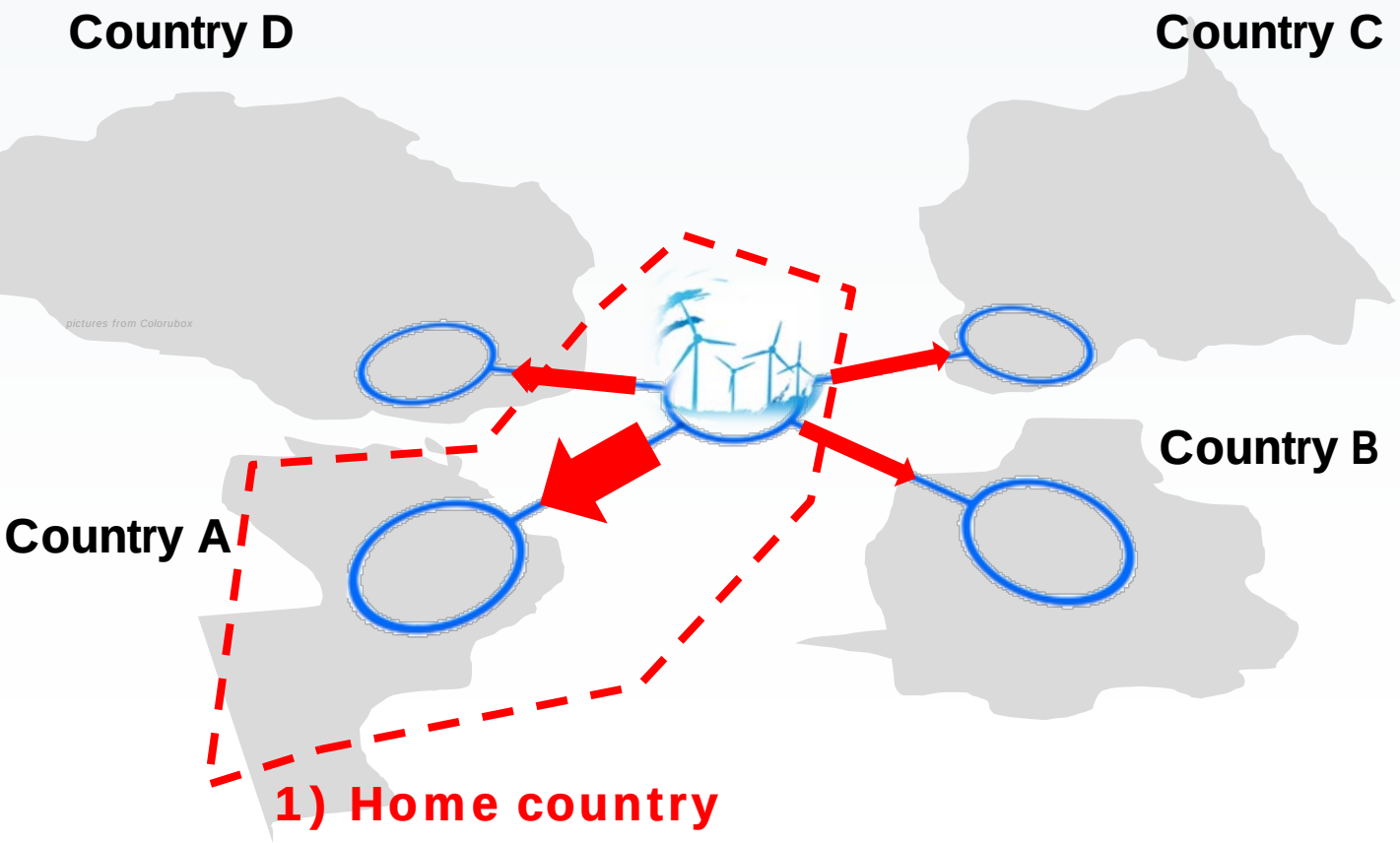

- Currently, offshore wind parks in Europe are single-country approaches
- Future meshed offshore grids will interconnect wind parks and countries
- Current research mostly from a macroscopic perspective

*Research Question*

How should production in offshore grids be regulated in terms of

- Market access
- Pricing rules
- Support scheme for RES

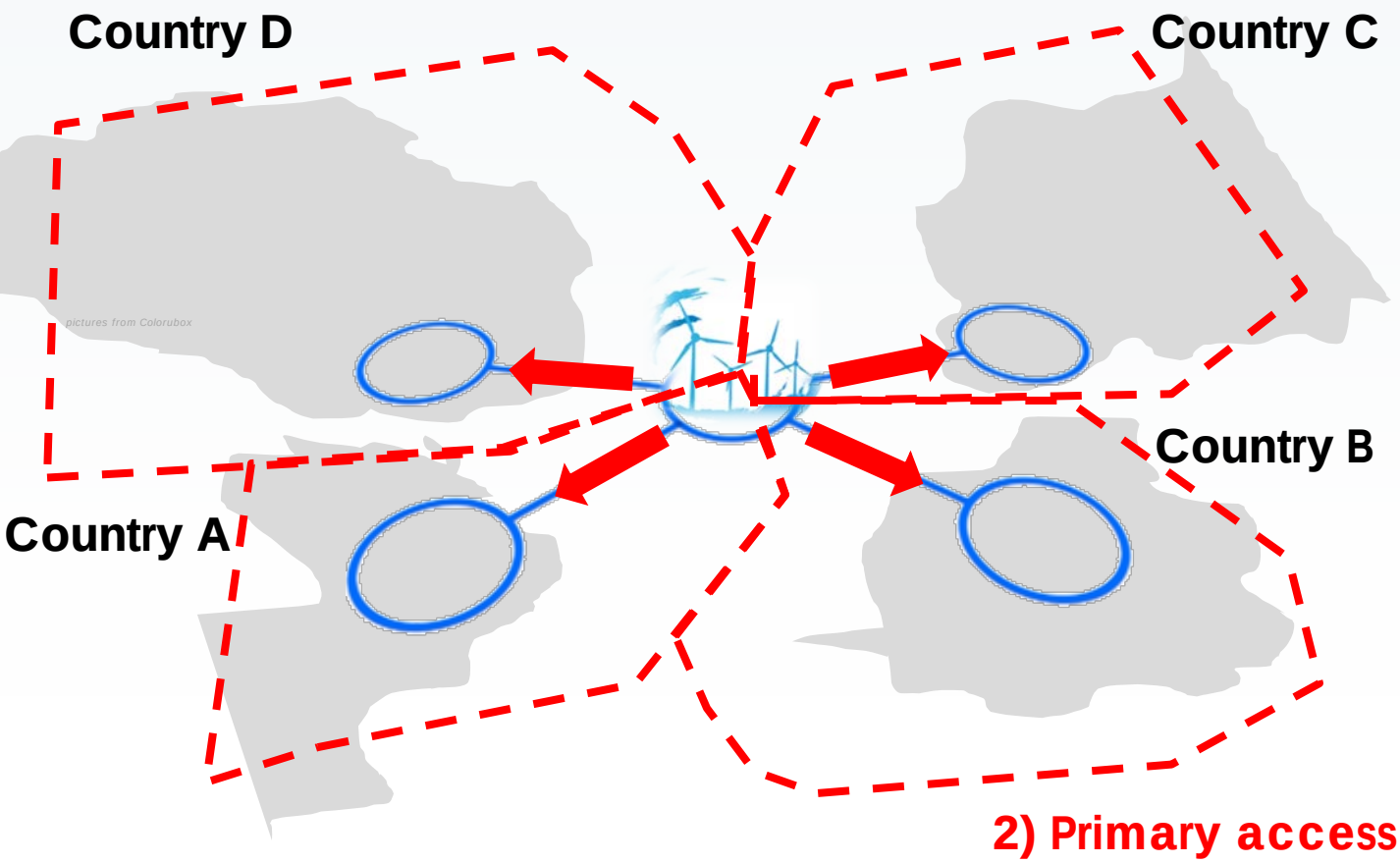
# Market access & Pricing rules: Option 1




## 1) Home country

- Production mostly integrated into the home market
- Wind park can choose alternative marketing region if attractive
- RES support only in home country
- Limited cross-country cooperation
- Remaining inter-connector capacities dispatched by TSO

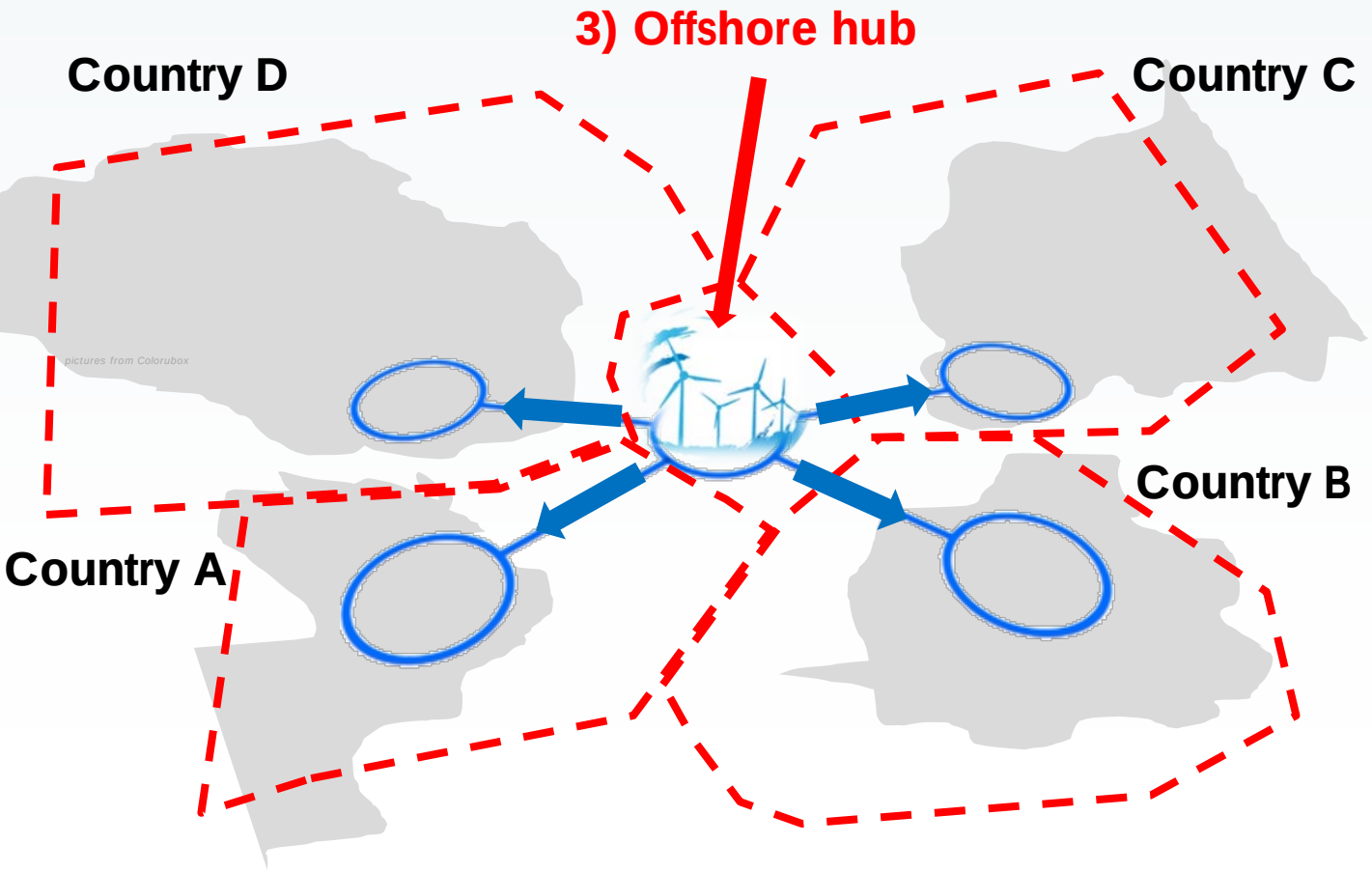
# Market access & Pricing rules: Option 2




## 2) Primary access

- Production is integrated into the most attractive of the neighbouring countries
- Wind park can choose its marketing region
- RES support in all countries
- Remaining inter-connector capacities dispatched by TSO

# Market access & Pricing rules: Option 3




## 3) Offshore hub

- Production of wind park forms its own market area
- No market choice for the wind park
- Joint RES support for the new market area
- All interconnector capacities dispatched by TSO

# Agenda

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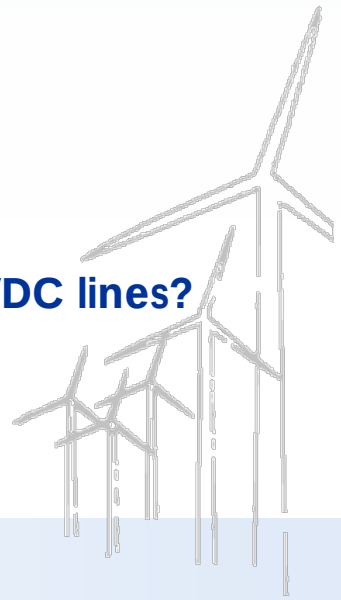
- Market Design: Regulatory framework challenges
  - Research case 1:
    From passive to active dynamic generation / market actors
    - Research question: **What contributes to the Wind Value?**
      **» and how to maximise it?**
  - Research case 2:
    Regulating future offshore grids
    - Research question: **Optimal conditions for Off-shore at HVDC lines?**



# Thank you for your interest

## Questions ?

email: klsk@dtu.dk